

Canada Housing Trust Swap Introduction

The Canada Housing Trust (CHT) Swap is a contract to exchange the interest portion of cash flows from a pass-through Mortgage-Backed Security (MBS) for coupon payments made by a Canadian Mortgage Bond (CMB).

The valuation of this swap is complicated by the fact the MBS has a coupon payment that depends on a principal balance that is affected by both scheduled and unscheduled principal payments. It is therefore very important to correctly specify and account for the prepayment behavior of the mortgage pools.

Fortunately, the majority of the mortgages in the portfolio are somewhat “protected” against prepayments that are interest rate dependent. This drastically simplifies the model, and allows one to value the swap using static cash flow projections.

Even given this, there is still a significant amount of model risk related to the prepayment behavior. The model valuation still depends very strongly on the assumptions made regarding prepayment. It is expected that the model will be re-evaluated as bank or industry standards develop regarding the prepayment behavior of Canadian mortgages.

An attempt was made to project the interest only cash flows from the MBS, and model the reinvestment and premium/discount amortization as described above. The argument made is that reinvestments should be implied from the valuation date yield curve, and therefore should not have any impact on the CHT Swap’s value. The same argument is made for ignoring the explicit premium/discount amortization payments.

Of course, a static cash flow model as proposed would definitely be incorrect if the prepayment of the MBS were dependent on interest rates. It is generally accepted that prepayments do in fact depend on interest rates, but in most of these swaps this is offset by what is called the Rate Differential Indemnity (RDI).

This RDI is present in all 975 series MBS, and all new swaps will include going forward will be of this type. Unfortunately, this is not true of the 970 series of MBS, and these currently represent 8% of total assets and are obviously declining as they mature and the portfolio is replaced by newer swaps. Since these are a small and declining portion, it is proposed that the rate dependence is ignored and a static cash flow model is used.

Mortgage liquidations are defined as prepayments resulting from the sale of the property on which the mortgage is held. These prepayments occur only when there is a bona fide sale of the mortgage property. This prepayment activity is assumed to be around 4% CPR on a per annum basis.

Mortgage customers are allowed to make partial prepayments up to 10% of the original principal, and/or increase their scheduled principal/interest payment by up to 10% annually. This prepayment activity is assumed to be approximately 1% CPR on a per annum basis

The CHT issues to third party investors Canada Mortgage Bonds (CMB). These bonds have maturities that are close to five years when issued, and are standard bullet bonds. The funds from the sale of these CMB are invested by CHT primarily into MBS. These MBS have maturities close to but no longer than the maturity of the CMB.

The principal amortization and prepayments (less premium/discount amortization, see below) for the MBS are reinvested by the CHT into new assets, and these are usually MBS assets unless it is “impractical” to do so. These reinvestments are made at prevailing market prices at the reinvestment time.

When a new CMB is issued its market value equals to the market value of the MBS purchased by the trust. This means that the notional values of these will generally not coincide (this will be true when the market price for either of them is not par). Furthermore, this notional mismatch will also result during the life of the deal when reinvestments are made, since these reinvestments will generally be made at prices other than par. The premium/discount amortization is designed to eliminate this mismatch so that the MBS and CMB notional are equal at the end of the deal.

The issue of valuation is very much simplified by the fact that these variable rate mortgage principals pay interest based on one month BA, and this rate resets monthly. The prepayment is not an issue with these mortgages, since the principal is replaced (at par) in the event of prepayment and the floating rate payments remain one month BA. Therefore, valuing these assets is a simple exercise of valuing them equivalent to a floating rate bond.

These amount to floating rate payments based on one month BA. The principal on which the interest payments are made will remain constant in the event of principal payments (both scheduled and unscheduled prepayments). Therefore, valuing this asset is a very simple calculation, with the results being very close to par and equal to par if the valuation date is right after the payment date. In fact, it is equivalent to valuing a floating rate bond with fixed notional.

The discount curve used for valuation (see <https://finpricing.com/lib/EqAsian.html>) is based on risk free rates. The interest accrued is also based on these rates, and the day count convention for the interest payment is also ACT / 365. Immediately after payment date, the value of the mortgage is par, equal to a floating rate bond.

In the event that the valuation date is in between payment dates, the value of the “mortgage” is not equal to par. Let t_0 is the last reset date, t_v is the valuation date and t_1 is the next interest payment. Also, let r_0 correspond to the last reset rate. On the valuation date, we let r_0 correspond to the overnight BA rate and r_{1m} correspond to the

30 day BA rate. Since the valuation date is between monthly swap payment dates, it is necessary to interpolate the effective BA rate for $t_1 - t_v$. Calling this r_v , the value of the “mortgage” is simply

$$V = \frac{1 + r_v \frac{t_v - t_0}{365}}{1 + r_o \frac{t_1 - t_0}{365}}$$

per dollar of notional. Again, this is equivalent to treating it as a floating rate bond. This is of course assuming the BA rates are simply compounded spot rates.

The valuation of the variable rate mortgage, as it contributes to the CHT swap is very simple. It is simplified by the fact that the interest rate payable is fixed at 30-day BA, and that we are discounting using the same curve that is used to evaluate the interest received. Furthermore, the principal payments on the variable rate mortgages, including prepayments, are reinvested at par so that the principal remains constant.

If this were not the case, it would be very difficult to properly value the cashflows from the mortgage. One would have to specify how the mortgage prepaid, and of course this would very dependent on relevant interest rates. Because of the interest rate dependence on the cashflows, this quickly becomes a path dependent problem with Monte Carlo required for valuation. It would be even more complicated if the cashflows were for example based on prime, since one would then need to have a model for how the prime rate and the interest rates are correlated.